E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
www.agronomyjournals.com
2024; SP-7(10): 614-617
Received: 22-07-2024
Accepted: 27-08-2024

Shivashankar M
Scientist, Department of Home Science, ICAR- KVK, Kandali, Hassan, Karnataka, India

Prem Kishor SN
Young Professional-II, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Yelahanka, Bangalore, Karnataka, India

Sanketh CV
Scientist, Department of Agricullture Extension, Sr. Scientist and Head, ICAR- KVK, Kandali, Hassan, Karnataka, India

Rajegowda
Sr. Scientist and Head, ICAR-KVK, Kandali, Hassan, Karnataka, India

CS Satish Gowda
Scientist, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Yelahanka, Bangalore, Karnataka, India

Corresponding Author:
Prem Kishor SN
Young Professional-II, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Yelahanka, Bangalore, Karnataka, India

Economic feasibility and trends in fish production: A case study of composite fish culture in Karnataka

Shivashankar M, Prem Kishor SN, Sanketh CV, Rajegowda and CS Satish Gowda

DOI: https://doi.org/10.33545/2618060X.2024.v7.i10Si.1855

Abstract
Hassan district, blessed with water resources like Hemavathi, Yagachi and Vatehole, has vast potential for fish farming. However, only 20,000 ha is utilized, yielding 250-300 kg of fish per hectare and 150-200 kg per acre in farm ponds. The Krishi Vigyan Kendra (KVK) identified key challenges in fish rearing, such as conventional monoculture practices and poor water management. To address these, KVK scientists introduced mixed cultivation (Catla, Rohu and Common carp) and conducted On-Farm Testing (OFT) and Frontline Demonstrations (FLDs). The study analyzed Karnataka's fish production trends from 2013-2023, revealing moderate fluctuations until 2020, followed by a sharp 76.64% increase post-2021. This surge was attributed to government policies, improved aquaculture practices and post-pandemic recovery. A case study on composite fish culture in a 0.2-hectare tank demonstrated its economic feasibility, with the farmer achieving a net profit of Rs. 60,816/- despite a 42.6% survival rate. The study highlights the potential for composite fish culture to enhance local livelihoods, with low input costs and adaptability to small-scale operations. Statistical tools like Microsoft Excel were used for data analysis and interviews with farmers provided insights into the challenges and benefits of fish farming. The findings emphasize the need for further research on policy impacts and technological advancements driving Karnataka's fisheries growth.

Keywords: Composite fish culture, fish production trends, aquaculture, economic viability

Introduction
Hassan district has been blessed with major water resources like Hemavathi, Yagachi and Vatehole and other minor sources such as large and small lakes and other community tanks. As per the data available, only about 20,000 ha is being used for fish rearing. Farmers are getting about 250-300 kgs of fish yield per ha. And they are getting about 150-200 kgs per acre in farm pond cultivation. Krishi Vigyan Kendra (KVK) team has surveyed and identified major problems in fish rearing such as following conventional methods as monoculture, unawareness about the high yielding varieties, their size and no knowledge while selecting fingerlings, poor water resource management, over seeding of fingerlings and stock density etc., (Krishi Vigyan Kendra, 2022) [12]. Considering all the above factors KVK scientist had intervened based on the Participatory Rural Appraisal (PRA) and farm visits and guided through introducing new technologies On Farm Testing (OFT), Frontline Demonstrations (FLDs) and need based training programmes to convey technologies such as mixed cultivation Catla, Rohu and Common carp etc., (ICAR, 2021).

Protocols Followed
As part of pre stocking management lime and cow dung were applied at the rate of 200-400 kg/ha and 4000 kg/ha respectively. Uniform sized Catla, Rohu and common carp fingerlings with average length of 6.5, 6.7 and 4.5cm respectively were brought from fingerlings rearing centre department of fisheries Hassan and three species combination of Catla, Rohu and Common carp in 20:10:20 ratio were sowed at 5,000 per acre in Hassan district.

Fingerlings management
Every month cow dung was applied at a rate of 2000 kg/ha and fishes were fed with ground nut

oil cake and rice bran in 1:1 ratio at a rate of 10 per cent of their body weight for the first month and which was reduced to 5 per cent for the last 6 months of culture period. Fish and water sampling were carried out once in month and analyzed water quality parameters were found to be within the permissible range for the growth of fishes.

Methodology

The methodology for this study consisted of two key components: An analysis of fish production trends in Karnataka from 2013 to 2023 and a case study on the feasibility of composite fish culture. Fish production data was sourced from official state and national fisheries reports, government databases and existing literature. The data was cleaned and processed to calculate year-over-year percentage changes, highlighting fluctuations and growth patterns (FAO, 2020; Sharma, 2018; Sarkar and Lakra, 2010) [8, 18, 17]. Statistical analysis, including descriptive metrics such as mean, standard deviation and percentage change, was performed to understand the trends. A line graph was generated to visually represent the fish production data over the 11-year period, revealing moderate fluctuations until 2020, followed by a significant rise in production post-2021. Potential reasons for these fluctuations and growth, such as environmental factors, government policies and industry changes, were discussed, particularly the substantial increase after 2020.

In parallel, a case study was conducted on a farmer practicing composite fish culture in a 0.2-hectare water storage tank. This involved stocking the tank with multiple compatible fish species, with inputs such as fish seed, manure, feed, labor and lime being documented. Over a 300–350-day period, the fish grew to an average weight of 420 grams, with a survival rate of 42.6%. The farmer’s total fish production, operational costs, gross income and net income were calculated to assess the economic viability of the system. The case study demonstrated that composite fish culture, even with low survival rates, can be a profitable venture. Interviews with the farmer provided insights into the challenges and successes of the practice, with local farmers expressing interest in adopting similar methods. The methodology also acknowledged certain limitations, such as data accuracy and variability in survival rates and used tools like Microsoft Excel for statistical analysis and visualization. This combination of quantitative data analysis and qualitative case study offers a comprehensive understanding of both broad fish production trends in Karnataka and the economic feasibility of small-scale composite fish culture systems (Kumar & Kumar, 2019; Biswas *et al*., 2006) [13, 3].

Results

The fish production data for Karnataka from 2013 to 2023 shows both fluctuations and significant growth in later years. Initially, fish production remained fairly stable, with moderate increases and decreases. In 2013, production was 546,440 metric tons, decreasing by 3.82% to 525,570 metric tons in 2014. The next year, production surged by 16.68% in 2015, reaching 613,241 metric tons, followed by another decline of 5.33% in 2016 (Ahmed and Garnett, 2011; Boyd, 2015) [1, 4]. This downward trend continued in 2017 with a 3.98% drop. (Table 1 and Fig 1)

Table 1: The fish production in Karnataka from 2013 to 2023. Additionally, here are the year-on-year percentage changes in fish production:

Year	Fish Production (Metric Tons)	Percentage Change (%)
2013	5,46,440	-
2014	5,25,570	-3.82%
2015	6,13,241	16.68%
2016	5,80,570	-5.33%
2017	5,57,490	-3.98%
2018	6,02,000	7.98%
2019	5,88,000	-2.33%
2020	6,32,000	7.48%
2021	6,08,000	-3.80%
2022	10,74,000	76.64%
2023	12,25,000	14.06%

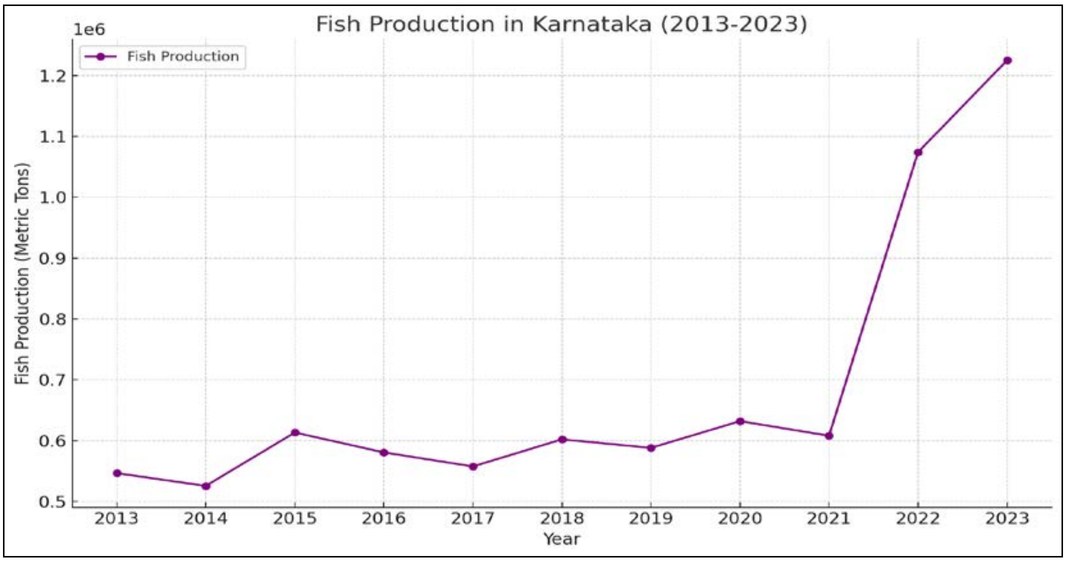

Fig 1: The line graph above illustrates the fish production in Karnataka from 2013 to 2023

However, production started to recover in 2018, increasing by 7.98% and continued fluctuating slightly over the next few years. The major change came after 2020, where production surged from 632,000 metric tons in 2020 to 1,074,000 metric tons in 2022, marking a dramatic 76.64% increase (De Silva and Davy, 2010) [5]. This growth continued in 2023, reaching 1,225,000 metric tons, an additional increase of 14.06% from the previous year.

The line graph (Fig 1) illustrates the fish production trends in Karnataka over a span of 11 years, from 2013 to 2023. As the graph shows, there was moderate fluctuation in production levels up until 2020, followed by a sharp increase starting in 2021, leading to a significant rise in fish output in the years that followed.

In the context of practical fish farming, a farmer engaged in a composite fish culture system successfully harvested 895 kg of fish over a 300–350-day culture period**.** The average weight of the fish at the time of harvest was 420 grams**,** with a survival rate of 42.6%**.** Despite the relatively modest survival rate, the fish were sold at a competitive price of Rs. 80 per kg**,** which resulted in a gross income of Rs. 71,568/-**.** After accounting for input costs, the farmer made a net profit of Rs. 60,816/-. This indicates that composite fish culture, even with low inputs, can be a feasible and profitable venture when managed efficiently in water storage tanks.

Table 2: Economies of composite fish culture in 0.2ha of water storage tank

Operational Cost	Quantity	Amount (Rs)
Cost of seed Rs. 250/1000 fingerlings	5000	1250=00
Cost of manure Rs. 5/kg	400	2000=00
Cost of feed Rs. 30/Kg	180	5400=00
Cost of labour Rs. 100/ labor /day X 3 days/crop	6	900=00
Cost of lime Rs. 15/ Kg	80	1200=00
Total operational cost		10,750=00
Total fish production		
Survival 42.6% X 5000 = 2130 Nos, Average weight 420 g X 2130 = 895 kg and sold at @ Rs.80 /kg		71,568=00
	Gross Income	71,568=00
Net income (Income – Total operational cost)		60,816=00

Discussion

The fish production data reflects two distinct phases: moderate fluctuations between 2013 and 2020 and a significant spike from 2021 onward. From 2013 to 2020, production varied within a relatively narrow range, reflecting a stable industry likely influenced by consistent fishing practices, market demand and environmental factors. The declines seen in certain years, such as 2014 and 2016, could be attributed to seasonal variations, regulatory impacts, or environmental challenges affecting both inland and marine fisheries.

The sharp increase in fish production starting in 2021 marks a significant shift, indicating a period of rapid expansion. Several factors could explain this surge. Government initiatives and policies aimed at boosting the fisheries sector, such as increased investments, subsidies, or the adoption of new technologies, might have played a major role in enhancing production capacities. Improved aquaculture practices, including better fish breeding techniques and sustainable fish farming methods, could have contributed to higher outputs. Additionally, the recovery from the COVID-19 pandemic may have accelerated growth as supply chains normalized and demand for seafood increased (Naylor *et al*., 2009; FAO, 2018) [7, 15].

The notable 76.64% increase in production between 2021 and 2022 is particularly striking. This substantial rise suggests that large-scale investments or shifts in fishery management may have occurred, possibly combined with favorable market conditions. The subsequent 14.06% growth in 2023 indicates continued expansion, although at a slower pace compared to the previous year's extraordinary growth. This continued increase may be driven by ongoing demand for fish products, both domestically and for export, alongside enhanced production efficiencies in the sector. Overall, the data demonstrates a stable production environment up to 2020, followed by a period of rapid growth, signaling potential structural changes within Karnataka's fisheries sector. Further research into policy changes, technological advancements and market dynamics during this period could provide more detailed insights into the drivers behind this significant rise in fish production.

Feasibility of Composite Fish Culture

This case demonstrates the potential for successful composite fish culture, especially in regions with limited water resources. By using water storage tanks, the farmer was able to cultivate fish over nearly a year with minimal inputs. Composite fish culture involves the stocking of multiple compatible fish species together in a single pond or tank, which optimizes the utilization of available resources like food, water and space. The farmer's ability to generate significant profit despite a relatively low survival rate shows the system’s resilience and economic potential (Jhingran, 1991; Pandey *et al*., 2013) [11, 16]. This culture practice not only supports household income but can also contribute to the local economy, particularly when fish are sold in neighbouring villages.

Farmer's Perspective and Experience

The success of this fish culture practice has fostered the farmer’s confidence in the economic viability of composite fish farming. The hands-on experience gained by the farmer through active participation in managing the fish culture system has built both technical skills and an understanding of the overall process. This practical knowledge, combined with tangible financial returns, has led to a growing interest in fish farming within the local community.

During demonstrations of composite fish culture, other farmers expressed their willingness to adopt this practice in their own ponds, motivated by the clear potential for income generation. The system’s adaptability, low input requirements and proven profitability are appealing to farmers, especially those with access to water storage tanks or small ponds. The demonstrated benefits - particularly the economic returns - have shown that even small-scale farmers can engage in aquaculture successfully, which could lead to broader adoption of composite fish culture techniques in the region (Bardach *et al.*, 1972; Kumar *et al.*, 2012) [2, 14].

Conclusion

The experience of the farmer highlights the feasibility and profitability of composite fish culture, especially when using low-cost inputs. The practical benefits, such as earning a net profit of Rs. 60,816/- and gaining valuable fish farming skills, underscore the potential of aquaculture as a viable livelihood option. This success, coupled with growing interest from other farmers, suggests that composite fish culture could play a significant role in enhancing rural livelihoods and contributing to food security in the region.

Reference

1. Ahmed N, Garnett ST. Integrated rice-fish farming in Bangladesh: meeting the challenges of food security. Food Sec. 2011;3:81-92.
2. Bardach JE, Ryther JH, McLarney WO. Aquaculture: the farming and husbandry of freshwater and marine organisms. New York: Wiley-Interscience; 1972.
3. Biswas G, Jena JK, Singh SK, Jha P. Effects of stocking density and fertilization on the growth and production of Rohu (*Labeo rohita*) and Catla (Catla catla). Aquac Res. 2006;37(14):1627-35.
4. Boyd CE. Water quality: an introduction. Berlin: Springer; 2015.
5. De Silva SS, Davy FB. Success stories in Asian aquaculture. Berlin: Springer; 2010.
6. Dhawan A, Kaur S. Pig dung as pond manure: effect on water quality, pond productivity and growth of carps in polyculture system. NAGA, ICLARM Q. 2001;24(1-2):11-4.
7. FAO. Small-scale aquaculture: empirical evidence and policy options for enhancing livelihoods and nutritional security in India. Rome: Food and Agriculture Organization of the United Nations; 2018.
8. FAO. The state of world fisheries and aquaculture 2020: sustainability in action. Rome: Food and Agriculture Organization of the United Nations; 2020.
9. ICAR (Indian Council of Agricultural Research). Handbook of fisheries and aquaculture. New Delhi: ICAR Press; 2021.
10. ICAR-CIFRI (Central Inland Fisheries Research Institute). Fisheries management in small reservoirs: guidelines for sustainability. Barrackpore: ICAR-CIFRI; 2018.
11. Jhingran VG. Fish and fisheries of India. New Delhi: Hindustan Publishing Corporation; 1991.
12. Krishi Vigyan Kendra. Annual report. Hassan, Karnataka; 2022.
13. Kumar B, Kumar S. An economic analysis of composite fish culture in Haryana, India. Econ Aff. 2019;64(3):581-7.
14. Kumar NR, Jena JK, Ayyappan S, Singh SK. Composite fish culture and management. In: Aquaculture practices in India. New Delhi: ICAR Press; 2012. p. 45-78.
15. Naylor RL, Hardy RW, Bureau DP, Chiu A, Elliott M, Farrell AP, Forster I. Feeding aquaculture in an era of finite resources. Proc Natl Acad Sci USA. 2009;106(36):15103-10.
16. Pandey AK, Singh RK, Pathak JK. Composite fish culture practices in India: An overview. Int J Fish Aquac. 2013;5(9):234-41.
17. Sarkar UK, Lakra WS. Freshwater fish diversity of India: an overview of habitat distribution and conservation status. Rev Fish Biol Fisheries. 2010;20(4):465-87.
18. Sharma R. Aquaculture practices and sustainable fish production in India. J Fish Livest Prod. 2018;6(3):234-41.